

Method 2 - Soil Direct Contact Standards (MCP Table 5)**Comparison of Combined Effect of (a) Proposed Simplified Soil Exposure Calculations and (b) Changes to Dermal Adherence Factor**

		Exposure Measures (Average Daily Exposure Rates)		
		1993 Approach	2000 Proposals	% Change
S-1	Noncancer			
	Ingestion	2.58	2.44	-5.42
	Dermal	28.55	21.08	-26.16
	Cancer			
	Ingestion	0.37	0.38	2.66
	Dermal	7.32	6.97	-4.67
S-2	Noncancer			
	Ingestion	0.29	0.27	-7.09
	Dermal	15.22	0.50	-96.72
	Cancer			
	Ingestion	0.11	0.11	-0.45
	Dermal	5.48	0.19	-96.48
S-3	Noncancer			
	Ingestion	0.63	0.63	-0.43
	Dermal	32.49	18.16	-44.10
	Cancer			
	Ingestion	0.03	0.03	7.97
	Dermal	1.49	0.91	-39.38

Key: Negative change indicates that the calculated exposure decreases.
This would result in a corresponding increase in the Method 2 Soil Standard.
(Less exposure means higher acceptable residual concentrations.)

S-1 Soil Exposure Assumptions

This spreadsheet calculates exposure factors for the a residential receptor, both for noncancer and cancer health endpoints. These factors are receptor-specific and apply regardless of contaminant of concern. These values are then used in combination with chemical-specific factors to calculate Risk Based Levels.

Soil Ingestion Exposures

	Average Body Weight BW kg	Soil Ingestion Rate IR mg/day	Eposure Frequency EF1 days/week	EF2 weeks/year	Exposure Period EP years	Averaging Period AP years	Conversion Constant C1 days/year	Conversion Constant C2 mg/kg	
Noncancer Risk									Average Daily Soil Ingestion Rate 1/day
Receptor:									
Resident, Age 1-8									
Age 1-8	16.8	100	5	30	7	7	365	1000000	2.44E-06
Receptor Total									
Cancer Risk									Lifetime Average Daily Soil Ingestion Rate 1/day
Receptor:									
Resident, Age 1-31									
Age 1-8	16.8	100	5	30	7				
Age 8-18	45.7	50	5	30	11				
Age 18-31	58.3	50	5	30	12				
Receptor Total					30	70	365	1000000	3.76E-07

Soil Dermal Exposures

	Average Body Weight BW kg	Average Skin Surface Area Exposed cm2/day	Soil Adherence Factor mg/cm2	Eposure Frequency EF1 days/week	EF2 weeks/year	Exposure Period EP years	Averaging Period AP years	Conversion Constant C1 days/year	Conversion Constant C2 mg/kg	
Noncancer Risk										Average Daily Soil Dermal Contact Rate 1/day
Receptor:										
Resident, Age 1-8										
Age 1-8	16.8	2433	0.35	5	30	7				
Receptor Total						7	7	365	1000000	2.11E-05
Cancer Risk										Lifetime Average Daily Soil Dermal Contact Rate 1/day
Receptor:										
Resident, Age 1-30										
Age 1-8	16.8	2433	0.35	5	30	7				
Age 8-18	45.7	4872	0.14	5	30	11				
Age 18-31	58.3	5654	0.13	5	30	12				
Receptor Total						30	70	365	1000000	6.97E-06

Body Weight Calculations (S-1):			
Age (years)	50th Percentile Body Weight Females kg	number of years	
1<2	10.8	1	
2<3	12.6	1	
3<4	14.6	1	
4<5	16.4	1	
5<6	18.8	1	
6<7	21	1	Average
7<8	23.5	1	1-8: 16.8
8<9	27.3	1	
9<10	29.6	1	
10<11	34.3	1	
11<12	40	1	
12<13	45.2	1	
13<14	48.6	1	
14<15	52.8	1	
15<16	53.9	1	
16<17	55.3	1	
17<18	58.3	1	Average
18<25	57.1	1	9-18: 45.7
18<25	57.1	7	Average
25<31	59.9	5	19 - 30: 58.3

Surface Area/Adherence Factor Calculations (S-1):											
Age (years)	Head	Face (1/3 of head)	Face Soil Adherence	Forearms	Forearms Soil Adherence	Hands	Hands Soil Adherence	Lower Legs	Lower Legs Soil Adherence	Feet	Feet Soil Adherence
	cm2	cm2	mg/cm2	cm2	mg/cm2	cm2	mg/cm2	cm2	mg/cm2	cm2	mg/cm2
1<2	855.2	282.216		305.8		274.7		481		326.5	
2<3	822.2	271.326		341.6		306.9		537.3		411.1	
3<4	882.6	291.258		467.3		395.9		697.8		467.3	
4<5	974.3	321.519		494.2		402.4		785.1		515.4	
5<6	1075	354.75		545.3		444		866.2		568.7	
6<7	1104.3	364.419		552.2		396.2		913.8		581.7	
7<8	1201.3	396.429		600.6		431		994		632.7	
1<8	987.8	326.0	0.006	472.4	0.027	378.7	1.5	753.6	0.2	500.5	0.26
8<9	1310	432.3		655		470		1084		690	
9<10	1272	419.76		651.9		561.8		1216.9		805.6	
10<11	1404	463.32		719.6		620.1		1343.2		889.2	
11<12	1560	514.8		799.5		689		1492.4		988	
12<13	1223.6	403.788		959		756		1708		980	
13<14	1475.6	486.948		895.4		754.8		1894.4		1184	
14<15	1545.4	509.982		937.8		790.5		1984		1240	
15<16	1249.7	412.401		949.9		800.7		2009.6		1256	
16<17	1273.6	420.288		1048		912		2150.4		1104	
17<18	1297.5	428.175		1426.3		831.3		2008.2		1189.9	
18<25	1110	366.3		1150		817		2180		1140	
8<18	1338.3	441.6	0.0574	926.6	0.082	727.6	0.318	1733.7	0.0419	1042.4	0.26
18<25	1110	366.3		1150		817		2180		1140	
25<31	1110	366.3		1150		817		2180		1140	
18<31	1110	366.3	0.0574	1150	0.082	817	0.318	2180	0.0419	1140	0.2563

S-2 Soil Exposure Assumptions

This spreadsheet calculates exposure factors for an adult commercial/industrial receptor, both for noncancer and cancer health endpoints. These factors are receptor-specific and apply regardless of contaminant of concern. These values are then used in combination with chemical-specific factors to calculate the S-2 Standards.

The worker is assumed to come into contact with contaminated soil infrequently, as an incidental exposure not related to their actual employment. Workers who have chronic, intense exposure to soil, like agricultural workers, should be addressed using the S-1 Soil Levels or a Method 3 Risk Characterization.

Soil Ingestion Exposures

									Average Daily Soil Ingestion Rate 1/day
Average Body Weight BW kg	Soil Ingestion Rate IR mg/day	Eposure Frequency EF1 EF2 days/week weeks/year		Exposure Period EP years	Averaging Period AP years	Conversion Constant C1 days/year	Conversion Constant C2 mg/kg		
Noncancer Risk									
Receptor:									
Adult Worker									
Age 18-45	60.1	50	4	30	27				
Receptor Total					27	27	365	1000000	
									2.74E-07
Cancer Risk									
Receptor:									
Adult Worker									
Age 18-45	60.1	50	4	30	27				
Receptor Total					27	70	365	1000000	
									1.05E-07

Soil Dermal Exposures

Noncancer Risk										Average Daily Soil Dermal Contact Rate 1/day
Receptor:										
Adult Worker										
Age 18-45										5.00E-07
Receptor Total										
Cancer Risk										
Receptor:										Lifetime Average Daily Soil Dermal Contact Rate 1/day
Adult Worker										
Age 18-45										
Receptor Total										1.93E-07

Body Weight Calculations (S-2):				
Age (years)	50th Percentile Body Weight Females kg	number of years		
18<25	57.1	7		
25<35	59.9	10	Average	
35<45	62.4	10	18<45:	60.1

Surface Area/Adherence Factor Calculations (S-2):													
Age (years)	Head		Face (1/3 of head)	Face Soil Adherence	Forearm cm2	Forearm Soil Adherence	Hands cm2	Hands Soil Adherence	Lower Legs cm2	Lower Legs Soil Adherence	Feet cm2	Feet Soil Adherence	
	cm2		cm2	mg/cm2	cm2	mg/cm2	cm2	mg/cm2	cm2	mg/cm2	cm2	mg/cm2	
18<25			1110	366.3		1150		817			1140		
25<35			1110	366.3		1150		817			1140		
35<45			1110	366.3		1150		817			1140		
18<45			1110	366.3	0.0058	1150	0.0133	817	0.0697	0	0.0011	1140	0.0149
												Adherence Factor 0.03	

S-3 Soil Exposure Assumptions

This spreadsheet calculates exposure factors for an adult construction/excavation worker receptor, both for noncancer and cancer health endpoints. These factors are receptor-specific and apply regardless of contaminant of concern. These values are then used in combination with chemical-specific factors to calculate S-3 Standards.

For noncancer risk calculations, the worker is assumed to come into contact with contaminated soil frequently and intensively while the work is on-going, but the duration of the exposure is assumed to be relatively short, consistent with a construction scenario. For the cancer risk calculations, the exposure is assumed to continue for seven years.

Soil Ingestion Exposures

								Average Daily Soil Ingestion Rate 1/day
	Average Body Weight BW kg	Soil Ingestion Rate IR mg/day	Eposure Frequency EF1 days/week	Exposure Period EP weeks	Averaging Period AP weeks	Conversion Constant C1 days/week	Conversion Constant C2 mg/kg	
Noncancer Risk								
Receptor:	Adult Worker							
	Age 22	57.1	50	5	13			
Receptor Total					13	13	7	1000000
								6.25E-07
Cancer Risk								Lifetime Average Daily Soil Ingestion Rate 1/day
Receptor:	Adult Worker				EF2 weeks/year	Exposure Period EP years	Averaging Period AP years	Conversion Constant C1 days/year
	Age 18-25	57.1	50	5	26	7		
Receptor Total						7	70	365
								1000000
								3.12E-08

Soil Dermal Exposures

									Average Daily Soil Dermal Contact Rate 1/day
Average Body Weight BW kg	Average Skin Surface Area Exposed cm2/day	Soil Adherence Factor mg/cm2	Exposure Frequency EF1 days/week	Exposure Period EP weeks	Averaging Period AP weeks	Conversion Constant C1 days/week	Conversion Constant C2 mg/kg		
Noncancer Risk									1.82E-05
Receptor:									
Adult Worker									
Age 22	57.1	5070	0.29	5	13				
Receptor Total					13	13	7	1000000	
Cancer Risk									Lifetime Average Daily Soil Dermal Contact Rate 1/day
				EF2	Exposure Period EP	Averaging Period AP	Conversion Constant C1		
				weeks/year	years	years	days/year		
Receptor:									
Adult Worker									
Age 18-25	57.1	5070	0.29	5	26	7			
Receptor Total						7	70	365	
									1000000
									9.06E-07

Body Weight Calculations (S-3):

Age (years)	50th Percentile Body Weight Females kg
18<25	57.1

Surface Area/Adherence Factor Calculations (S-3):

Age (years)	Head	Face (1/3 of head)	Face Soil Adherence	Forearm Soil Adherence	Forearm ng/cm ²	Hands cm ²	Hands Adherence mg/cm ²	Lower Legs cm ²	Lower Legs Adherence mg/cm ²	Feet cm ²	Feet Adherence ng/cm ²	Adherence Factor
18<25	1110	366.3	0.1102	1150	0.328	817	0.3487			1140	0.256	0.29